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## MIC Testing

Committee Report  
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There are **two methods** acceptable to the Tennessee State Fire Marshal's Office (SFMO) for evaluating the potential for corrosion affecting automatic sprinkler systems in buildings **(1) Tennessee registered designer's evaluation and recommendation based on third party laboratory test data and engineering judgment or (2) by a general knowledge assurance as documented on the SFMO MIC Waiver Letter which is signed, dated, and sealed by the designer and signed by the building's owner.**

Projects under the jurisdiction of the Tennessee State Fire Marshal's Office must be evaluated for Microbiologically Influenced Corrosion (MIC) affecting automatic sprinkler systems. [TCA 68-120-101(a)(2), Rule 0780-2-2-.01(1)(b), 2002 NFPA 13 15.1.5, and 2002 NFPA 25] The building owners maintain liability for their property at all times for both design and maintenance and are required by law and rule to secure the services of registered design professionals. [TCA 62-2-102 and Rule 0780-2-3-.02 Submission of Plans] These registrants act as the owners' agent and may address microbial influenced corrosion (MIC) and associated environmental conditions by one of the following:

### 1. MIC Test

Formally evaluate and recommend any action necessary to mitigate MIC based on scientific judgment and testing (inorganic and organic) of the water supply for new and existing sprinkler systems by a third party testing laboratory plus any necessary site or sprinkler piping investigations (MIC Testing). This documentation is to be shown as a component of plans that contain a registrant's seal. Also, forward the test lab data through email directly from the lab to our office (Codes Enforcement Section (website link)) so that the test data can be collected and tracked from across the state for research purposes.

2002 NFPA 13 15.1.5 "Water supplies and environmental conditions shall be evaluated for the existence of microbes and conditions that contribute to microbiologically influenced corrosion (MIC). Where conditions are found that contribute to MIC, the owner(s) shall notify the sprinkler system installer and a plan shall be developed to treat the system using one of the following methods:

- (1) Install a water pipe that will not be affected by the MIC microbes.
- (2) Treat all water that enters the system using an approved biocide.
- (3) Implement an approved plan for monitoring the interior conditions of the pipe at established time intervals and locations."

## 2. MIC Waiver Letter

Complete a MIC Waiver Letter available through the State Fire Marshal's Office (SFMO) which is signed, dated, and sealed by a Tennessee registered designer evaluating the MIC and the building's owner signs and dates the form. **This waiver letter is to validate that the designer has general knowledge of the long-term condition of sprinkler systems with similar piping materials in similar environments on the same water supply for this project.** The MIC Waiver Letter is attached to the approved plans once issued.

ANNEX A, 2002 NFPA 13 A.15.1.5 "Evaluation of the water supply and environmental conditions does not necessarily require a water sample analysis by a laboratory. Instead, general knowledge of the long-term condition of sprinkler systems with similar piping materials in similar environments on the same water supply can be a sufficient evaluation.

There are several options to address the effects of MIC on sprinkler systems. Some types of sprinkler pipe such as CPVC have not shown to be affected by MIC. Other types of pipe are being manufactured with a biofilm that resists the effects of MIC.

Where water supplies are treated with biocides, evaluation of the effects of the biocide on sprinkler system components (pipe, fittings, sprinklers, gaskets, valves, and seals) is just as important as evaluating the effect the biocide has on the organisms. Where water treatment is selected as the method to deal with MIC, all water entering the system during testing or flushing needs to be treated so that the organisms don't get a chance to establish themselves.

Since all of the conditions that can effect the growth of MIC are unknown, a plan to sample randomly selected interior positions in the system can be effective. The frequency and location of the interior inspections will depend on the extent of the known MIC problem with the same water supply and similar environmental conditions."

Our office will accept a previously issued MIC evaluation with lab test data within **six** months of the initial design drawing submittal date for new buildings, but not for the expansion of existing sprinkler systems.

## MIC Testing

### 1. Test Mandate

- A. MIC testing by a third party laboratory is required for all new and existing buildings that will be sprinklered and when expanding an existing sprinkler system (Sprinkler Design Intent correction list).
- B. "General Knowledge" or "to the best of my knowledge" letters are accepted, but only when completed by a Tennessee registered designer and building's owner on a form issued by the SFMO.

### 2. Test Laboratory

The approved third party testing lab must be ISO certified and nationally recognized or pre-approved by the State Fire Marshal's Office.

### 3. Test Criteria

- A. **Test method:** Acceptable test methods must be objective in nature. Subjective test methods such as visual, tactile, or olfactory observations will not be accepted except as supportive evidence. Laboratory tests shall consist of two classifications:

- a. **Inorganic:** This class of tests establishes aquatic environmental factors which can promote microbial growth and/or indicate microbiological activity. Inorganic water test must include at a minimum but not be limited to the following:
    - i. Total Dissolved Solids (TDS) test (water source un-filterable mineral content)
    - ii. Langlier Index (LI) – chemical calculation that determines if water is corrosive or scaling in nature
      - 1. pH test (pH) – electrical/chemical measurement which establishes if water is acid or basic (attacking or caustic/depositing)
      - 2. Temperature (TF) of water sample during job site sampling
      - 3. Alkalinity (AF) test as  $\text{CaCO}_3$
      - 4. Calcium (CF) as  $\text{CaCO}_3$
    - iii. Silica (Si) test – general indicator of electro-chemical reactions
    - iv. Iron test (Fe) – determines if iron has been dissolved into the water
    - v. Sulfate ( $\text{SO}_4$ ), Hydrogen Sulfide ( $\text{H}_2\text{S}$ ), Sulfide ion ( $\text{S}^-$ ) tests – indicator of stability/ activity of a water sample
    - vi. Dissolved Oxygen (DO) – change in level indicates corrosive activity within the pipe
  - b. **Organic** (microbiological): These classifications of tests (commonly known as a BART test) are used to specifically identify the type of microbes which may influence corrosion. The influence may be direct or indirect. Examples of direct acting are bacteria which directly consume (eat) iron. An example of indirect acting bacteria would be that which produces a byproduct which itself alters the aquatic environment. Such byproducts may cause oxidation (rust), mineral deposits (scaling, tubercles, etc.), dissolves system materials (iron and other metals) may compromise materials by such means as chemical reaction by lowering pH (creating acid water) or flocculation. Organic test must include at a minimum but not be limited to the following:
    - i. Aerobic and Anaerobic (Heterotrophic) Bacteria (HAB) – requiring or oxygen independent organisms
    - ii. Coliform (TC) – hazardous to occupants and respondents
    - iii. Iron Related Bacteria (IRB) – material and component damaging
    - iv. Sulfate Reducing Bacteria (SRB) - material and component damaging
    - v. Slime Forming (SLYM) – material and component damaging
- B. **Test samples:** Samples must be taken in a manner acceptable to both the qualified laboratory and the State Fire Marshal's Office. Minimum samples must be acquired and analyzed based on whether the system is new or existing.
- a. New buildings – test water supply (fire hydrant from water main serving building).
  - b. Existing buildings - provide test samples from:
    - i. Each sprinkler system riser's main drain
    - ii. Each inspectors test port(s)
    - iii. Most remote potable faucet, hydrant, toilet supply, lavatory, utility sink, or other
    - iv. Water supply fire hydrant

#### 4. Test Evaluation and Recommendations

Evaluation of test results and recommendations: Interpretation of test results must be by a registrant of the Tennessee State Board of Architectural and Engineering Examiners who must prepare a written report that is included directly in the plans which are required. [TCA 62-2-102 and Rule 0780-2-3] A plan approval will be available even if the water supply tested positive however, no Certificate of Occupancy or Letter of Completion will be available until corrective action has been initiated and the MIC has been responsibly addressed (see Follow Up Testing below).

The lab test data must appear directly as a component of the plan set with the evaluation and recommendations and the plans must be sealed by the registrant according to the statutes and rules regulating the practice of Architecture and Engineering in the state of Tennessee. The report must be in outline form contain the following:

- A. **Test Data** – Approved laboratory water sample test results (organic and inorganic) included directly and without modification of any kind.
- B. **Water Samples** – Person, firm, date of sample, and where sample(s) were collected
- C. **Method** – Test methods used employed.
- D. **Evaluation** – Includes comparative analysis between samples over time and location (existing buildings) and may contain personal and professional rationale used in forming the conclusions.
- E. **Recommendation** – This must contain a recommendation regardless of the need to develop a mitigation plan. The registrant of record must support his/her recommendation by a combination of objective (third party lab test results, sampling, etc.) and subjective (professional history of project, familiarity with similar situations, and professional expertise) data.

#### 5. Follow Up Testing

Follow up third party lab testing is required only if the initial lab test, system component samples, and/or environmental conditions are indicative of active MIC or favorable conditions exist to develop MIC. The plans must be revised after any required mitigation design has been realized and a subsequent round of testing performed. The follow up tests then are to be included directly in plans and a follow up report written which properly demonstrates how the mitigation plan is effectively addressing the MIC.